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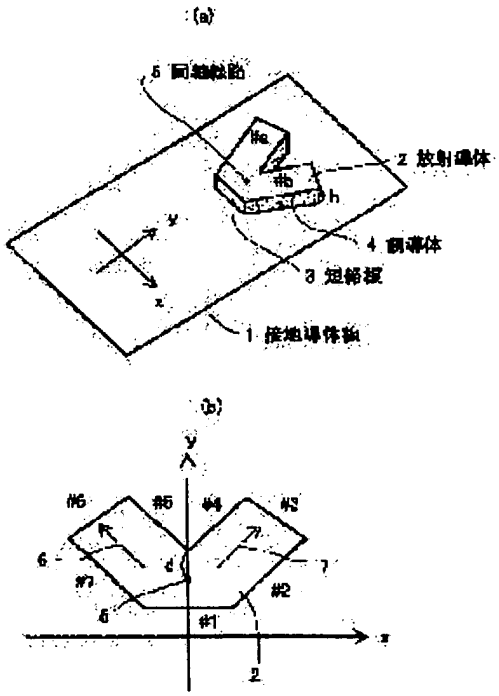
(54) ANTENNA, AND PORTABLE TERMINAL PROVIDED WITH THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an antenna having a nearly equal mount area to that of a conventional antenna whose reception efficiency can be enhanced and to provide a portable terminal provided with it.

SOLUTION: A radiating conductor 2 formed on a ground on a ground conductor plate 1 being a case of the portable terminal via dielectric body 4, a short- circuit plate 3 interconnecting the ground conductor plate 1 and a 1st side #1 of the radiating conductor 2, and a coaxial line 5 feeding the radiating conductor 2 are placed on the ground conductor plate 1. A flat part spread in an upper left direction of the radiating conductor 2 forms a 1st radiating part #a and a flat part spread in an upper right direction of the radiating conductor 2 forms a 2nd radiating part #b, and the 1st side #1 is placed nearly orthogonally to the length direction of the portable terminal. Using the 1st and 2nd radiating parts #a, #b can receive radio waves in different polarized wave directions without a polarization loss.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The antenna which is equipped with the following and characterized by the flat-surface portion of the above 1st and the flat-surface portion of the above 2nd forming the radiant section which receives the electric wave of the different direction of polarization. grounding -- a conductor -- a board this grounding -- a conductor -- the radiation which has the 1st flat-surface portion which counters a board and spreads in the 1st direction, and the 2nd flat-surface portion which spreads in the 2nd direction -- a conductor this radiation -- a conductor and the aforementioned grounding -- a conductor -- the shorting bar which connects a board the aforementioned radiation -- an electric supply means to supply electric power to a conductor
[Claim 2] The aforementioned electric supply means is an antenna according to claim 1 characterized by supplying electric power to the above 1st and the 2nd flat-surface portion from the one electric supply section.
[Claim 3] The aforementioned electric supply means is an antenna according to claim 1 characterized by having the two electric supply sections which supply electric power to the above 1st and the 2nd flat-surface portion, respectively.

[Claim 4] The personal digital assistant characterized by providing the following grounding which is a case -- a conductor -- a board this grounding -- a conductor -- the radiation which has the 1st flat-surface portion which counters a board and spreads in the 1st direction, and the 2nd flat-surface portion which spreads in the 2nd direction -- a conductor this radiation -- a conductor and the aforementioned grounding -- the shorting bar which connects a conductor the aforementioned radiation -- the radiant section to which the flat-surface portion of the above 1st receives the polarization of an abbreviation perpendicular direction when it has an electric supply means to supply electric power to a conductor and the aforementioned case is leaned -- forming -- the flat-surface portion of the above 2nd -- abbreviation -- the antenna characterized by forming the radiant section which receives horizontal polarization

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the antenna of the small and the thin shape which aimed at improvement in receiving efficiency by realizing polarization common use, and the personal digital assistant equipped with it in the built-in antenna for personal digital assistants represented by the cellular phone.
[0002]
[Description of the Prior Art] In the land-mobile communication using L band represented by the cellular phone, the electric wave of a vertically polarized wave is emitted from a base station. By the reflection and dispersion from a surrounding building and a surrounding tree, the electric wave of various linearly polarized waves arrives at the place of a personal digital assistant. If these arrival electric waves are divided into a polarization component level to a perpendicular, although a horizontally polarized wave is -6dB low level of abbreviation compared with a vertically polarized wave, generally both polarization will have come in equivalent.
[0003] The antenna as shown in drawing 8 is built in the personal digital assistant. namely, grounding which is the case of a personal digital assistant -- a conductor -- a board 81 top -- a dielectric 83 -- minding -- radiation -- a conductor 82 forms -- having -- the end -- a shorting bar 84 -- grounding -- a conductor -- it connected with the board 81 and has connected too hastily moreover, radiation -- the coaxial track 85 which supplies electric power in a conductor 82 is formed
[0004] However, a personal digital assistant is used in the state where it inclined about 60 degrees from the normal axis. Therefore, when the micro-stripe antenna of a single-sided short circuit shown in drawing 8 as a built-in antenna is used, the cos component and sin component of a perpendicular and a horizontally polarized wave will be received. For this reason, the polarization loss generally said occurs and the problem that receiving efficiency falls occurs.
[0005] If this is explained using drawing 9 , the antenna 91 built in the personal digital assistant 90 will receive a linearly polarized wave 92 most efficiently. However, if the electric wave which arrives at a terminal is divided into the vertically-polarized-wave component 93 and the horizontally-polarized-wave component 94, the built-in antenna 91 will receive the sin component 96 of the cos component 95 of the vertically-polarized-wave component 93, and the horizontally-polarized-wave component 94. For this reason, polarization loss arises.
[0006]
[Problem(s) to be Solved by the Invention] As mentioned above, when it decomposed into the perpendicular and the horizontally-polarized-wave component and the arrival electric wave was considered, since the cos component and sin component of an arrival electric wave would be received, polarization loss occurred and the conventional built-in antenna for personal digital assistants had the trouble said that receiving efficiency falls.
[0007] this invention solves the trouble of the above conventional technology, and aims at offering the antenna which aimed at improvement in receiving efficiency in an antenna area almost equivalent to the conventional antenna, and the personal digital assistant equipped with it.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the antenna concerning this invention according to claim 1 grounding -- a conductor -- a board and this grounding -- a conductor -- the radiation which has the 1st flat-surface portion which counters a board and spreads in the 1st direction, and the 2nd flat-surface portion which spreads in the 2nd direction -- with a conductor this radiation -- a conductor and grounding -- a conductor -- the shorting bar which connects a board, and radiation -- it has an electric supply means to supply electric power to a conductor, and the 1st flat-surface portion and the 2nd flat-surface portion are characterized by forming the radiant section which receives the electric wave of the different direction of polarization
[0009] According to the antenna of such composition, it can receive without polarization loss of the electric wave of

the different direction of polarization, and polarization efficiency can be raised.
[0010] this invention according to claim 2 is characterized by an electric supply means supplying electric power to the 1st and 2nd flat-surface portions from the one electric supply section in an antenna according to claim 1.
[0011] It is characterized by this invention according to claim 3 having the two electric supply sections to which an electric supply means supplies electric power to the 1st and 2nd flat-surface portions, respectively in an antenna according to claim 1.
[0012] Since the electric supply to the 1st and 2nd flat-surface portions is separately controllable by the two electric supply sections while it is receivable without polarization loss of the electric wave of the different direction of polarization according to such composition, polarization diversity reception can also be performed.
[0013] The personal digital assistant equipped with the antenna concerning this invention according to claim 4 grounding which is a case -- a conductor -- a board and this grounding -- a conductor -- the radiation which has the 1st flat-surface portion which counters a board and spreads in the 1st direction, and the 2nd flat-surface portion which spreads in the 2nd direction -- with a conductor this radiation -- a conductor and grounding -- the shorting bar which connects a conductor, and radiation -- the radiant section to which the 1st flat-surface portion receives the polarization of an abbreviation perpendicular direction when it has an electric supply means to supply electric power to a conductor and a case is leaned -- forming -- the 2nd flat-surface portion -- abbreviation -- it is characterized by forming the radiant section which receives horizontal polarization
[0014] According to the personal digital assistant equipped with the antenna of such composition, it can receive without polarization loss of the electric wave of a vertically polarized wave and a horizontally polarized wave, and good communication can be performed with a base station.
[0015]
[Embodiments of the Invention] Hereafter, with reference to a drawing, the operation form of this invention is explained in detail.
[0016] the perspective diagram and this drawing (b) in which drawing 1's being drawing showing the composition of the personal digital assistant equipped with the antenna concerning the 1st operation form of this invention, and showing [this] the composition of the principal part (a) -- the radiation -- it is the plan showing the arrangement state of a conductor
[0017] grounding which is the case of a personal digital assistant as shown in this drawing -- a conductor -- the radiation formed through the dielectric 4 on the board 1 -- a conductor 2 and grounding -- a conductor -- a board 1 and radiation -- the shorting bar 3 which connects and short-circuits the 1st side #1 of a conductor 2, and radiation -- it consists of coaxial tracks 5 which supply electric power in a conductor 2
[0018] here -- radiation -- the 1st side which the conductor 2 short-circuited -- #1 -- carrying out -- right-handed rotation -- radiation -- if it numbers each side of a conductor 2 -- radiation -- a conductor 2 the 1st side #1 -- the part or all -- grounding -- it connects with a conductor 1 too hastily -- having -- side #2 and 4th side # -- the 4 and 5th side #5 and 7th side #7 is parallel, and the 4th side #4 and 5th side #5 is right-angled [of ** a 2nd] Furthermore, the 3rd side #3 and the 4th side #4 intersect perpendicularly, and the 6th side #6 lies at right angles to the 5th side #5. moreover, the 1st side #1 is intersected perpendicularly with the y-axis which is the longitudinal direction of a case (grounding a conductor board) 1 -- as -- radiation -- a conductor 2 is arranged on a case (grounding a conductor board) 1 That is, it is symmetrical structure to the y-axis shown in drawing 1 .
[0019] considering as such composition -- radiation -- 1st radiant-section #a by the flat-surface portion which spreads in the direction of upper left including the portion 1st on the left-hand side of side #1 connected with the conductor 2 too hastily Moreover, 2nd radiant-section #b is formed of the flat-surface portion which spreads in the direction of upper right including the short-circuited portion 1st on the right-hand side of side #1. As shown in drawing 1 (b), to the y-axis, 1st radiant-section #a becomes the polarization 7 of a direction 45 degrees to the y-axis, and, as for both the polarization 6 and 7, the polarization 6 of the direction of -45 degrees and 2nd radiant-section #b lie at right angles.
[0020] Then, considering the case where a case 1 is leaned in the direction of a x axis 45 degrees, 1st radiant-section #a receives the electric wave of a vertically polarized wave, and 2nd radiant-section #b receives the electric wave of a horizontally polarized wave. That is, polarization level to a perpendicular will be most efficiently received by designing so that the antenna element which has each radiant-section #a and #b may resonate on predetermined frequency.
[0021] the ground in the reflection loss and resonance frequency in the antenna composition shown in drawing 2 (a) and (b) at drawing 1 -- a conductor -- a board 1 and radiation -- the contour line of the electric field Ez between conductors 2 is shown, respectively in addition, drawing 2 (b) -- resonance frequency -- f and the 1st length of side #1 -- the L#1 and 2nd length of side #2 -- the L#2 and 3rd length of side #3 -- the L#3 and 6th length of side #6 -- the L#6 and 7th length of side #7 -- the thickness of L#7 and a dielectric 4 -- h -- When distance to the feeding point according

the dielectric constant of a dielectric 4 to a coaxial track 5 is set to d from epsilonr, the 4th side #4, and the 5th node of side #5, It is a thing about the case of f= 1.32GHz, L#3=L#6=25.0mm, L#2=L#7=38.0mm, h= 5mm, epsilonr=1.0, d= 7.0mm, and L#1=28.28mm.

[0022] From this drawing, the coaxial track 5 and adjustment whose antenna of this operation gestalt is a feeder way are achieved. Moreover, since the electric-field distribution by the 1st radiant-section #a, the 3rd side #3 which is the radiation edge of 2nd radiant-section #b, and 6th side #6 has appeared most strongly and both lie at right angles further When a case 1 is leaned about 45 degrees, the antenna of this operation gestalt is the polarization of both a vertically polarized wave and a horizontally polarized wave, and it turns out that it is operating by predetermined resonance frequency.

[0023] In addition, in an above-mentioned case, although polarization level to a perpendicular was considered as the composition received most efficiently when a case 1 was leaned about 45 degrees, when a case 1 is leaned about 60 degrees, it can also consider as the composition which receives polarization level to a perpendicular most efficiently. in order to consider as such composition, as shown in drawing 3 , the 1st side #1 inclines -15 degrees to a x axis -- as -- radiation -- arranging a conductor 2 on a case (grounding a conductor board) 1 -- then, it is good

[0024] furthermore, radiation -- the arrangement to the case (grounding a conductor board) 1 of a conductor 2 can consider not only an above-mentioned case but various methods that what is necessary is just to receive polarization level to a perpendicular most efficiently, when a case 1 is leaned the degree of predetermined angle

[0025] Moreover, as shown in drawing 4 (a), when the width of face (namely, the 6th length of side #6) of 1st radiant-section #a and the width of face (namely, the 3rd length of side #3) of 2nd radiant-section #b are changed as a modification of this operation gestalt Also in the antenna composition at the time of changing the 4th length of side #4, and the 5th length of side #5, as shown in drawing 4 (b), 1st radiant-section #a and 2nd radiant-section #b operate by the linearly polarized wave which intersected perpendicularly. Therefore, even if it uses this antenna composition, improvement in receiving efficiency can be aimed at. Furthermore, since the resonance frequency of 1st radiant-section #a and 2nd radiant-section #b is controllable by changing length and width of face, wide-band-izing, 2 cycle-ization, etc. can also be attained. That is, by lengthening length, it is low in resonance frequency, and can wide-band-ize by making width of face large.

[0026] Furthermore, although above-mentioned explanation explained the case where the 2nd side #2 and 4th side #4 and 5th side #5 and 7th side #7 was parallel, the 2nd side #2 and 4th side #4 and 5th side #5 and 7th side #7 may not be parallel.

[0027] moreover, the radiation shown in drawing 1 -- a slit and a U character type slot can also be established on a conductor 2 namely, drawing 5 (a) and (b) -- respectively -- radiation -- the modification which established the slit type slot 32 of 31 or U characters on the conductor 2 is shown Also in this antenna composition, 1st radiant-section #a and 2nd radiant-section #b operate by the linearly polarized wave which intersected perpendicularly. furthermore, radiation -- establishing a slit 31 and the U character type slot 32 on a conductor 2 -- radiation -- the current which flows on a conductor 2 can be changed and resonance frequency can be reduced Therefore, the miniaturization of an antenna can be attained.

[0028] the radiation shown in drawing 6 at drawing 1 -- the 1st side #1 and shorting bar 3 of a conductor 2 -- radiation -- a conductor -- the modification bent in the direction of [inner] is shown radiation -- each a part or all of 1st side #1b of a conductor 2, and side 1a of the octavus -- shorting-bar 61b and shorting-bar 61a -- respectively -- grounding -- a conductor -- it has connected with a board (not shown) Also in this antenna composition, 1st radiant-section #a and 2nd radiant-section #b operate by the linearly polarized wave which intersected perpendicularly. in addition, this case -- radiation -- changing the 6th length of side #6 of a conductor 2, and the 3rd length of side #3 **** -- the 4th length of side #4, and the 5th length of side #5 -- changing -- you may make -- radiation -- you may establish a slit and a U character type slot on a conductor 2

[0029] Next, the personal digital assistant equipped with the antenna concerning the 2nd operation gestalt of this invention is explained.

[0030] This operation form inserts a shorting bar between 1st radiant-section #a and 2nd radiant-section #b in the 1st operation form, and to 1st radiant-section #a and 2nd radiant-section #b, it constitutes it so that electric power can be supplied separately, respectively.

[0031] Drawing 7 is the plan showing the composition of this 2nd operation form.

[0032] the portion (all are boiled and it continues) of the straight line to which what is shown in this drawing (a) connects the 4th side #4, the 5th node of side #5, and the 1st arbitrary point of side #1, and grounding -- a conductor -- the shorting bar 71 connected and the board (not shown) has short-circuited And 1st radiant-section #a and 2nd radiant-section #b are constituted so that electric supply may be performed by coaxial track 5a and coaxial track 5b, respectively.

[0033] moreover, the thing shown in this drawing (b) -- radiation -- the portion (all are boiled and it continues) of the straight line which connects the node of 1st side #1b and side #1a of the octavus in a conductor 2 which were short-circuited, and the 4th side #4 and the 5th node of side #5, and grounding -- a conductor -- the shorting bar 71 connected and the board (not shown) has short-circuited And 1st radiant-section #a and 2nd radiant-section #b are constituted so that electric supply may be performed by coaxial track 5a and coaxial track 5b, respectively.
[0034] in addition, radiation -- as well as the case of the 1st operation gestalt when a case 1 is leaned the degree of predetermined angle, the arrangement to the case (grounding a conductor board) 1 of a conductor 2 should just arrange polarization level to a perpendicular so that it may receive most efficiently
[0035] Since 1st radiant-section #a, coaxial track 5a which supplies electric power to 2nd radiant-section #b, and coaxial track 5b are prepared, in the case of this 2nd operation gestalt, the electric supply set to 1st radiant-section #a and 2nd radiant-section #b is separately controllable, and it becomes possible [performing diversity transmission and reception of a vertically polarized wave and a horizontally polarized wave].
[0036] When you suppose that reception is performed by the diversity, and the better one is taken, or both are compounded when following, for example, receiving the arrival electric wave from a base station and you transmit to a base station, suppose that electric power is supplied only to the antenna element of the direction which was the fitness of a receiving state.
[0037] moreover, this 2nd operation gestalt -- also setting -- the case of the 1st operation gestalt -- the same -- radiation -- changing the 6th length of side #6 of a conductor 2, and the 3rd length of side #3 **** -- the 4th length of side #4, and the 5th length of side #5 -- changing -- you may make -- radiation -- you may prepare a slit on a conductor 2
[0038] In addition, with each above operation gestalt, as an electric supply method, although coaxial electric supply explained, the strip line, electric supply by the electromagnetic coupling, etc. can be used.
[0039] furthermore -- each above operation gestalt -- radiation -- although the conductor 2 was made into the thing of the polygon which consists of each straight-line-like side -- radiation -- if the configuration of a conductor 2 has the flat-surface portion which spreads not only in this but in the 1st direction, and the flat-surface portion which spreads in the 2nd direction, it can be made into the various configurations which consist of combination of a curve or a straight line
[0040]
[Effect of the Invention] The volume of an antenna can reduce further by being able to solve the trouble which says that the receiving efficiency which is the polarization loss which generates in the conventional built-in antenna for terminals falls according to this invention, and being able to aim at improvement in receiving efficiency by the component-side product almost equivalent to the conventional antenna, and establishing a slit and a U character type slot, and there is an effect referred to as being able to aim at the further miniaturization and reduction of cost.

[Translation done.]

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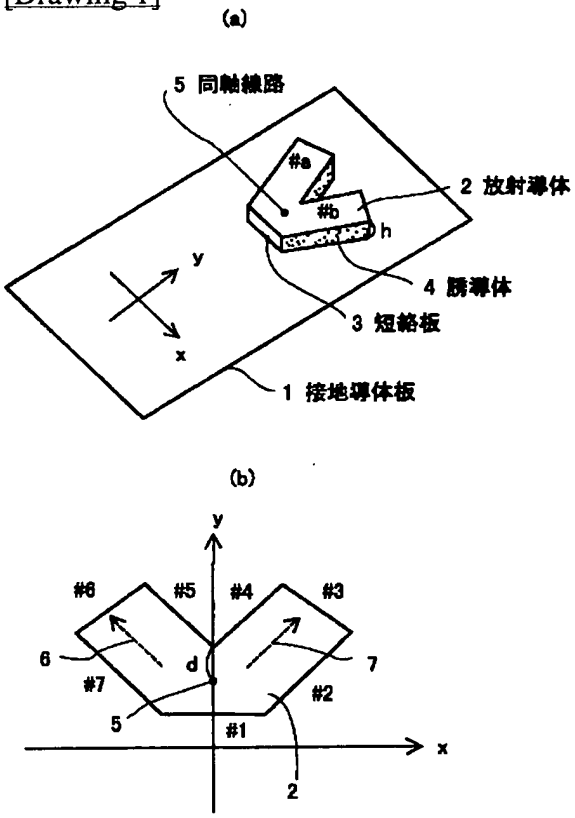
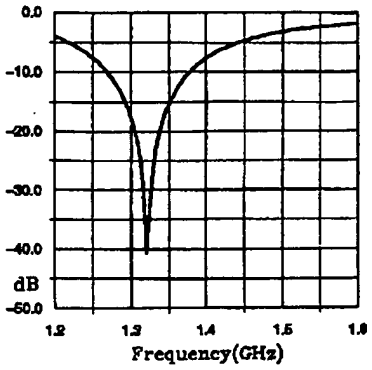
DRAWINGS

[Drawing 1]



[Drawing 2]

(a)



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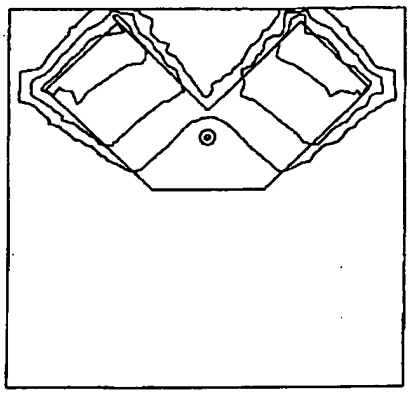
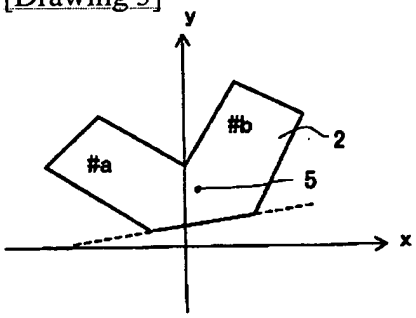
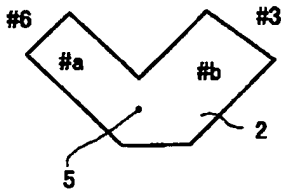


[Drawing 3]



[Drawing 4]

(a)



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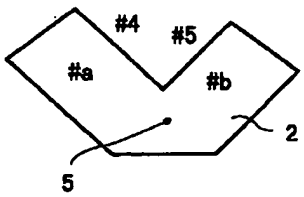
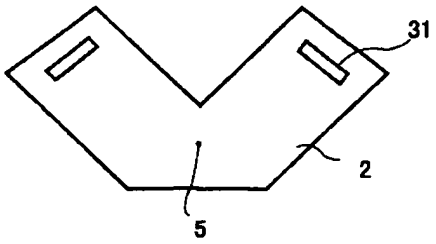


[Drawing 5]

(a)



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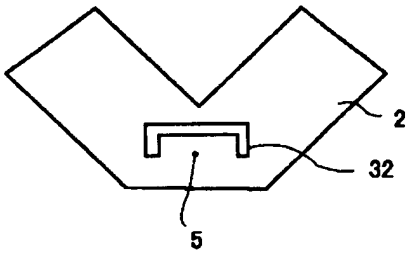
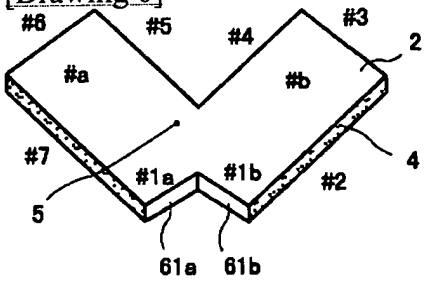
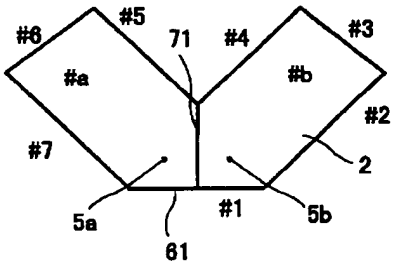


[Drawing 6]



[Drawing 7]

(a)



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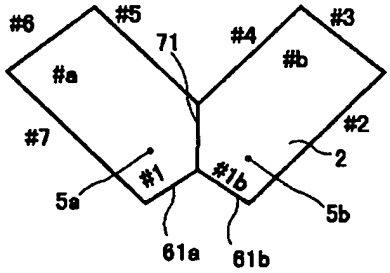
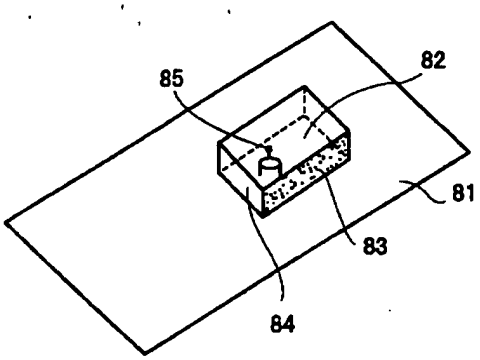
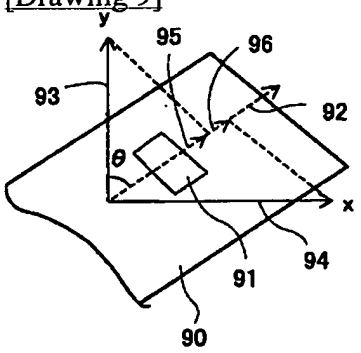


[Drawing 8]



[Drawing 9]



[Translation done.]

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// Ｈ０４Ｂ　7/26		Ｈ０４Ｂ　7/26	Ｂ	５Ｋ０６７

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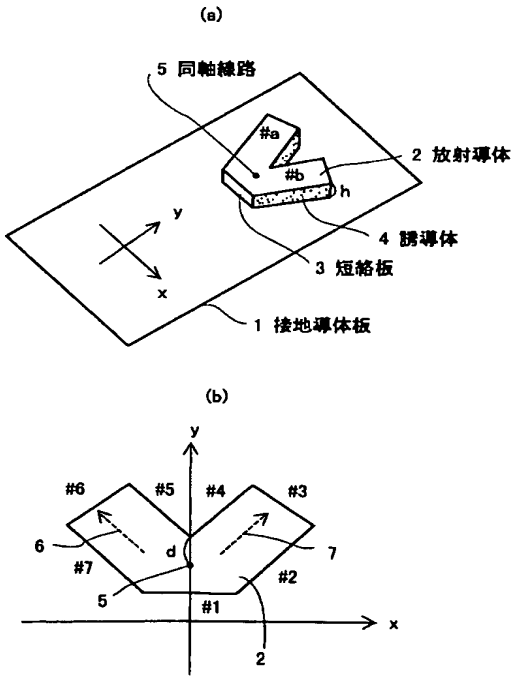
5J045 AA12 AA21 AB05 AB06 DA10 EA07 HA06 MA07 NA03
5J047 AA04 AB13 FD01
5K067 AA42 KK01 KK17

(54)【発明の名称】　アンテナ、及びそれを備えた携帯端末

(57)【要約】
【課題】　従来のアンテナとほぼ同等な実装面積で、受信効率の向上を図ったアンテナ、及びそれを備えた携帯端末用を提供する。
【解決手段】　携帯端末の筐体である接地導体板１上に、誘電体４を介して形成された放射導体２と、接地導体板１と放射導体２の第１の辺＃１とを接続する短絡板３と、放射導体２を給電する同軸線路５を設けて、放射導体２の左上方向に広がる平面部分により第１の放射部＃ａ、右上方向に広がる平面部分により第２の放射部＃ｂを形成し、携帯端末の長手方向に対して、第１の辺＃１をほぼ直交する方向に配置する。第１及び第２の放射部＃ａ，＃ｂにより、異なる偏波方向の電波を偏波損失なしで受信することができる。



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【特許請求の範囲】

【請求項１】接地導体板と、この接地導体板に対向し、第１の方向に広がる第１の平面部分と第２の方向に広がる第２の平面部分とを有する放射導体と、この放射導体と前記接地導体板とを接続する短絡板と、前記放射導体に給電を行う給電手段とを備え、前記第１の平面部分及び前記第２の平面部分が、異なる偏波方向の電波を受信する放射部を形成することを特徴とするアンテナ。

【請求項２】前記給電手段は、１つの給電部から前記第１及び第２の平面部分に給電することを特徴とする請求項１に記載のアンテナ。

【請求項３】前記給電手段は、前記第１及び第２の平面部分にそれぞれ給電する２つの給電部を有することを特徴とする請求項１に記載のアンテナ。

【請求項４】筐体である接地導体板と、この接地導体板に対向し、第１の方向に広がる第１の平面部分と第２の方向に広がる第２の平面部分とを有する放射導体と、この放射導体と前記接地導体とを接続する短絡板と、前記放射導体に給電を行う給電手段とを備え、前記筐体を傾けたとき前記第１の平面部分が略垂直方向の偏波を受信する放射部を形成し、前記第２の平面部分が略水平方向の偏波を受信する放射部を形成することを特徴とするアンテナを備えた携帯端末。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、携帯電話に代表される携帯端末用の内蔵アンテナにおいて、偏波共用を実現することで受信効率の向上を図った小型・薄型のアンテナ、及びそれを備えた携帯端末に関する。

【０００２】

【従来の技術】携帯電話に代表されるＬ帯を用いた陸上移動通信においては、基地局から垂直偏波の電波が放射される。周囲の建物や樹木からの反射・散乱によって、携帯端末の所には、様々な直線偏波の電波が到来する。これらの到来電波を垂直と水平の偏波成分に分けると一般的には、水平偏波は垂直偏波に比べ約－６ｄＢ低いレベルであるが、等価的には両方の偏波が到来している。

【０００３】携帯端末には、図８に示すようなアンテナが内蔵されている。即ち、携帯端末の筐体である接地導体板８１上に、誘電体８３を介して放射導体８２が形成され、その一端は、短絡板８４により接地導体板８１と接続されて短絡されている。また放射導体８２を給電する同軸線路８５が設けられている。

【０００４】しかし、携帯端末は垂直軸から約６０度傾いた状態で使われる。従って、内蔵アンテナとして図８に示す片側短絡のマイクロストリップアンテナなどを用いると垂直・水平偏波のｃｏｓ成分やｓｉｎ成分を受信することになる。このために、一般に言う偏波損失が発生し、受信効率が低下するという問題が発生する。

【０００５】これを、図９を用いて説明すると、携帯端末９０に内蔵されているアンテナ９１は、直線偏波９２を最も効率よく受信する。しかし、端末に到来する電波を垂直偏波成分９３と水平偏波成分９４に分けると、内蔵アンテナ９１は、垂直偏波成分９３のｃｏｓ成分９５と水平偏波成分９４のｓｉｎ成分９６を受信する。このため、偏波損失が生じる。

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【０００６】

【発明が解決しようとする課題】上述したように、到来電波を垂直・水平偏波成分に分解して考えると、従来の携帯端末用内蔵アンテナは、到来電波のｃｏｓ成分やｓｉｎ成分を受信することになるために、偏波損失が発生し、受信効率が低下すると言う問題点があった。

【０００７】本発明は、上記のような従来技術の問題点を解決し、従来のアンテナとほぼ同等なアンテナ面積で受信効率の向上を図ったアンテナ、及びそれを備えた携帯端末を提供することを目的とする。

【０００８】

【課題を解決するための手段】上記の課題を解決するために、請求項１に記載の本発明に係るアンテナは、接地導体板と、この接地導体板に対向し、第１の方向に広がる第１の平面部分と第２の方向に広がる第２の平面部分とを有する放射導体と、この放射導体と接地導体板とを接続する短絡板と、放射導体に給電を行う給電手段とを備え、第１の平面部分及び第２の平面部分が、異なる偏波方向の電波を受信する放射部を形成することを特徴とする。

【０００９】このような構成のアンテナによれば、異なる偏波方向の電波を偏波損失なしで受信することができ、偏波効率を向上させることができる。

【００１０】請求項２に記載の本発明は、請求項１に記載のアンテナにおいて、給電手段が、１つの給電部から第１及び第２の平面部分に給電することを特徴とする。

【００１１】請求項３に記載の本発明は、請求項１に記載のアンテナにおいて、給電手段が、第１及び第２の平面部分にそれぞれ給電する２つの給電部を有することを特徴とする。

【００１２】このような構成によれば、異なる偏波方向の電波を偏波損失なしで受信することができるとともに、２つの給電部により第１及び第２の平面部分に対する給電を別々に制御することができるので、偏波ダイバーシティ受信を行なうこともできる。

【００１３】請求項４に記載の本発明に係るアンテナを備えた携帯端末は、筐体である接地導体板と、この接地導体板に対向し、第１の方向に広がる第１の平面部分と第２の方向に広がる第２の平面部分とを有する放射導体と、この放射導体と接地導体とを接続する短絡板と、放射導体に給電を行う給電手段とを備え、筐体を傾けたとき第１の平面部分が略垂直方向の偏波を受信する放射部を形成し、第２の平面部分が略水平方向の偏波を受信する放射部を形成することを特徴とする。

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【００１４】このような構成のアンテナを備えた携帯端末によれば、垂直偏波と水平偏波の電波を偏波損失なしで受信することができ、基地局と良好な通信を行なうことができる。

【００１５】

【発明の実施の形態】以下、図面を参照して本発明の実施形態について詳細に説明する。

【００１６】図１は、本発明の第１の実施形態に係るアンテナを備えた携帯端末の構成を示す図で、同図（ａ）はその主要部の構成を示す斜視図、同図（ｂ）はその放射導体の配置状態を示す平面図である。

【００１７】同図に示すように、携帯端末の筐体である接地導体板１上に、誘電体４を介して形成された放射導体２と、接地導体板１と放射導体２の第１の辺＃１とを接続し短絡する短絡板３と、放射導体２を給電する同軸線路５で構成されている。

【００１８】ここで、放射導体２の短絡された第１の辺を＃１として、右回りに放射導体２の各辺に番号を付けると、放射導体２は、第１の辺＃１はその一部もしくは全部が接地導体１と短絡され、第２の辺＃２と第４の辺＃４、及び第５の辺＃５と第７の辺＃７が平行で、第４の辺＃４と第５の辺＃５は直角である。更に、第３の辺＃３と第４の辺＃４とが直交し、第５の辺＃５と第６の辺＃６も直交している。また、第１の辺＃１を筐体（接地導体板）１の長手方向であるｙ軸と直交するように放射導体２を筐体（接地導体板）１上に配置する。すなわち図１に示したｙ軸に対して対称な構造である。

【００１９】この様な構成とすることで放射導体２には、短絡した第１の辺＃１の左側の部分を含み左上の方向に広がる平面部分により第１の放射部＃ａが、また短絡した第１の辺＃１の右側の部分を含み右上の方向に広がる平面部分により第２の放射部＃ｂが形成され、図１（ｂ）に示すように第１の放射部＃ａがｙ軸に対して－４５度方向の偏波６、第２の放射部＃ｂがｙ軸に対して、４５度方向の偏波７となり、両偏波６，７は、直交している。

【００２０】そこで、筐体１をｘ軸方向に４５度傾けた場合を考えると、第１の放射部＃ａが垂直偏波の電波を受信し、第２の放射部＃ｂが水平偏波の電波を受信する。即ち、各放射部＃ａ，＃ｂを有するアンテナ素子が所定の周波数で共振するように設計することで、垂直と水平の偏波を、最も効率良く受信することになる。

【００２１】図２（ａ）及び（ｂ）に、図１に示したアンテナ構成での反射損失と共振周波数における地導体板１と放射導体２間の電界Ｅｚの等高線をそれぞれ示す。なお、図２（ｂ）は、共振周波数をｆ、第１の辺＃１の長さをＬ＃１、第２の辺＃２の長さをＬ＃２、第３の辺＃３の長さをＬ＃３、第６の辺＃６の長さをＬ＃６、第７の辺＃７の長さをＬ＃７、誘電体４の厚さをｈ、誘電体４の誘電率をεｒ、第４の辺＃４と第５の辺＃５の接

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続点から同軸線路５による給電点までの距離をｄとしたとき、ｆ＝１．３２ＧＨｚ、Ｌ＃３＝Ｌ＃６＝２５．０ｍｍ、Ｌ＃２＝Ｌ＃７＝３８．０ｍｍ、ｈ＝５ｍｍ、εｒ＝１．０、ｄ＝７．０ｍｍ、Ｌ＃１＝２８．２８ｍｍの場合についてのものである。

【００２２】この図より、この実施形態のアンテナは給電線路である同軸線路５と整合が図られており、また、第１の放射部＃ａと第２の放射部＃ｂの放射端である第３の辺＃３と第６の辺＃６での電界分布が最も強く現れており、更に、両者は直交しているので、筐体１をほぼ４５度傾けるとこの実施形態のアンテナは垂直偏波と水平偏波の両方の偏波で、所定の共振周波数で動作していることが分かる。

【００２３】なお、上述の場合は、筐体１をほぼ４５度傾けた場合に、垂直と水平の偏波を、最も効率良く受信する構成としたが、筐体１をほぼ６０度傾けた場合に、垂直と水平の偏波を、最も効率良く受信する構成とすることもできる。このような構成とするには、図３に示すように、第１の辺＃１がｘ軸に対して－１５度傾くように放射導体２を筐体（接地導体板）１上に配置することとすればよい。

【００２４】更に、放射導体２の筐体（接地導体板）１に対する配置は、筐体１を所定角度傾けた場合に、垂直と水平の偏波を、最も効率良く受信するようにすればよく、上述の場合に限らず、種々の方法が考えられる。

【００２５】また、この実施形態の変形例として、図４（ａ）に示すように第１の放射部＃ａの幅（即ち第６の辺＃６の長さ）と第２の放射部＃ｂの幅（即ち第３の辺＃３の長さ）とを違えた場合も、図４（ｂ）に示すように第４の辺＃４の長さと第５の辺＃５の長さとを違えた場合のアンテナ構成においても、第１の放射部＃ａと第２の放射部＃ｂは直交した直線偏波で動作する。従って、このアンテナ構成を用いても、受信効率の向上が図れる。更に、長さや幅をかえることで第１の放射部＃ａと第２の放射部＃ｂの共振周波数を制御できるので、広帯域化や２周波化等を図ることも出来る。即ち、長さを長くすることにより共振周波数を低く、また幅を広くすることにより広帯域化することができる。

【００２６】更に、上述の説明では、第２の辺＃２と第４の辺＃４、及び第５の辺＃５と第７の辺＃７が平行である場合について説明したが、第２の辺＃２と第４の辺＃４、及び第５の辺＃５と第７の辺＃７が平行でなくてもよい。

【００２７】また、図１に示した放射導体２上にスリットやＵ字型スロットを設けることもできる。即ち図５（ａ）および（ｂ）は、それぞれ放射導体２上にスリット３１、Ｕ字型スロット３２を設けた変形例を示したものである。このアンテナ構成においても、第１の放射部＃ａと第２の放射部＃ｂは直交した直線偏波で動作する。更に、放射導体２上にスリット３１やＵ字型スロッ

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ト３２を設けることで、放射導体２上に流れる電流を変化させ共振周波数を低下させることができる。よって、アンテナの小型化を図ることができる。

【００２８】図６に、図１に示した放射導体２の第１の辺＃１と短絡板３を放射導体内の方向に折り曲げた変形例を示す。放射導体２の第１の辺＃１ｂと第８の辺１ａの各々の一部もしくは全部を、短絡板６１ｂと短絡板６１ａにより、それぞれ接地導体板（図示せず）に接続している。このアンテナ構成においても、第１の放射部＃ａと第２の放射部＃ｂは直交した直線偏波で動作する。なお、この場合も、放射導体２の第６の辺＃６の長さと第３の辺＃３の長さとを違えたり、第４の辺＃４の長さと第５の辺＃５の長さとを違えるようにしてもよいし、放射導体２上にスリットやＵ字型スロットを設けてもよい。

【００２９】次に、本発明の第２の実施形態に係るアンテナを備えた携帯端末について説明する。

【００３０】この実施形態は、第１の実施形態における第１の放射部＃ａと第２の放射部＃ｂとの間に短絡板を挿入し、第１の放射部＃ａと第２の放射部＃ｂに対し、それぞれ別々に給電を行うことができるように構成したものである。

【００３１】図７は、この第２の実施形態の構成を示す平面図である。

【００３２】同図（ａ）に示すものは、第４の辺＃４と第５の辺＃５の接続点と、第１の辺＃１の任意の点とを結ぶ直線の（全部に亘る）部分と、接地導体板（図示せず）とが短絡板７１により接続され短絡されている。そして第１の放射部＃ａと第２の放射部＃ｂは、それぞれ同軸線路５ａ、同軸線路５ｂにより給電が行われるように構成している。

【００３３】また、同図（ｂ）に示すものは、放射導体２における短絡された第１の辺＃１ｂと第８の辺＃１ａとの接続点と、第４の辺＃４と第５の辺＃５の接続点とを結ぶ直線の（全部に亘る）部分と、接地導体板（図示せず）とが短絡板７１により接続され短絡されている。そして第１の放射部＃ａと第２の放射部＃ｂは、それぞれ同軸線路５ａ、同軸線路５ｂにより給電が行われるように構成している。

【００３４】なお、放射導体２の筐体（接地導体板）１に対する配置は、第１の実施形態の場合と同様に、筐体１を所定角度傾けた場合に、垂直と水平の偏波を、最も効率良く受信するように配置すればよい。

【００３５】この第２の実施形態の場合は、第１の放射部＃ａと第２の放射部＃ｂに対し給電を行う同軸線路５ａ、同軸線路５ｂを設けているので、第１の放射部＃ａと第２の放射部＃ｂにする給電を別々に制御することができ、垂直偏波と水平偏波のダイバーシティ送受信を行なうことが可能となる。

【００３６】従って、例えば、基地局からの到来電波を

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受信するとき、受信はダイバーシティで行い、良好な方を取るか、あるいは両方を合成することとし、基地局に送信するときは、受信状態の良好であった方のアンテナ素子にのみ給電を行うこととすることができる。

【００３７】また、この第２の実施形態においても、第１の実施形態の場合と同様に、放射導体２の第６の辺＃６の長さと第３の辺＃３の長さとを違えたり、第４の辺＃４の長さと第５の辺＃５の長さとを違えるようにしてもよいし、放射導体２上にスリットを設けてもよい。

【００３８】なお、以上の各実施形態では、給電方式として、同軸給電で説明したが、ストリップ線路や電磁結合による給電等を用いることが出来る。

【００３９】更に、以上の各実施形態では、放射導体２を、直線状の各辺からなる多角形のものとしたが、放射導体２の形状は、これに限らず、第１の方向に広がる平面部分と第２の方向に広がる平面部分とを有するものであれば、曲線や直線の組み合わせからなる種々の形状とすることができる。

【００４０】

【発明の効果】本発明によれば、従来の端末用内蔵アンテナにおいて発生する偏波損失である受信効率が低下すると言う問題点を解決し、従来のアンテナとほぼ同等な実装面積で、受信効率の向上を図ることが出来、またスリットやＵ字型スロットを設けることで更にアンテナの体積を減らすことが出来、更なる小型化、及びコストの低減が図れると言う効果がある。

【図面の簡単な説明】

【図１】　本発明の第１の実施形態に係るアンテナを備えた携帯端末の構成を示す図で、（ａ）はその主要部の構成を示す斜視図、（ｂ）はその放射導体の配置状態を示す平面図。

【図２】　本発明の第１の実施形態におけるアンテナの特性を示す図で、（ａ）はその反射損失を示す図、（ｂ）はその電界分布を示す図。

【図３】　第１の実施形態の変形例の放射導体の配置状態を示す平面図。

【図４】　第１の実施形態の変形例の主要部の構成を示す平面図。

【図５】　第１の実施形態の変形例の主要部の構成を示す平面図。

【図６】　第１の実施形態の変形例の主要部の構成を示す斜視図。

【図７】　本発明の第２の実施形態に係るアンテナを備えた携帯端末の構成を示す平面図。

【図８】　従来例の構成を示す斜視図。

【図９】　偏波損失が発生することを説明するための図。

【符号の説明】

１…接地導体板（筐体）

２…放射導体

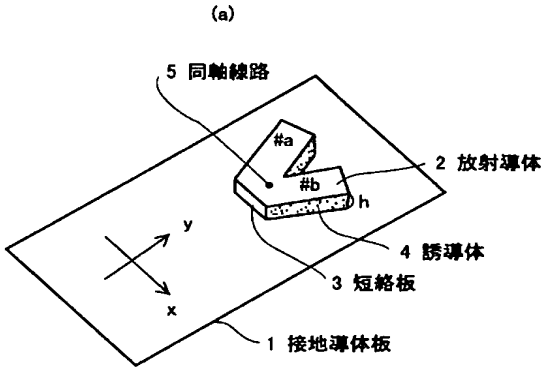
7

3，６１，６１ａ，６１ｂ，７１…短絡板
4…誘電体
5，５ａ，５ｂ…同軸線路

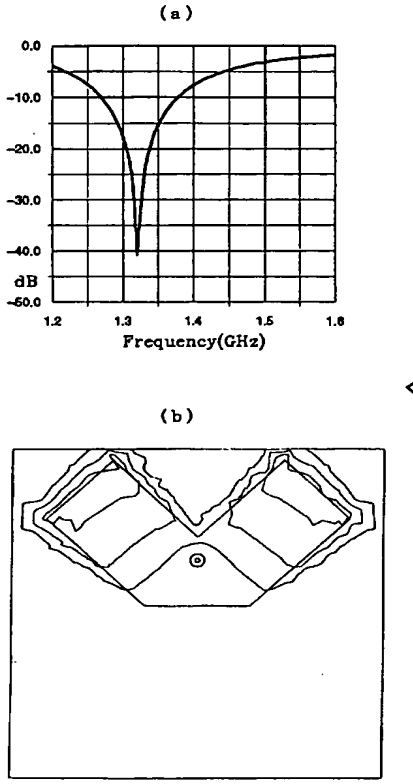
8

6，７…偏波
３１…スリット
３２…Ｕ字型スロット

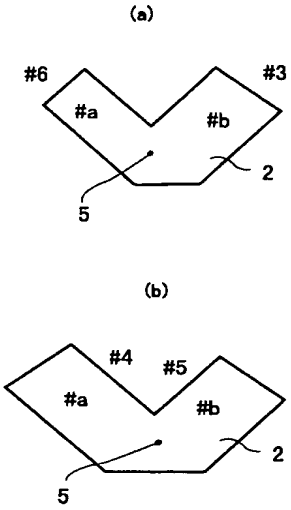
【図１】



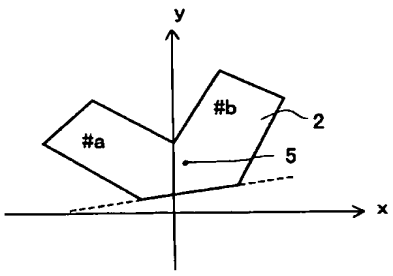
【図２】



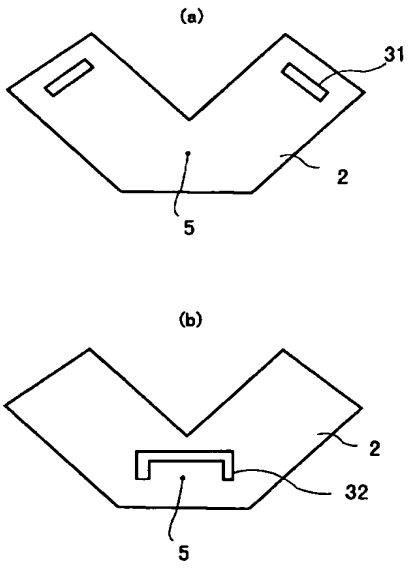
【図４】



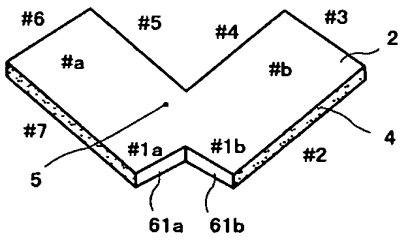
【図３】



【図５】

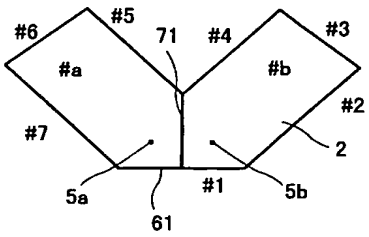


【図６】

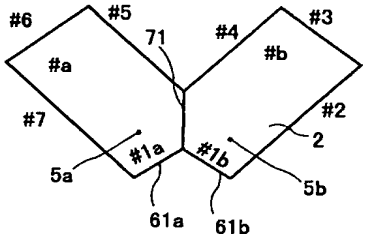


【図７】

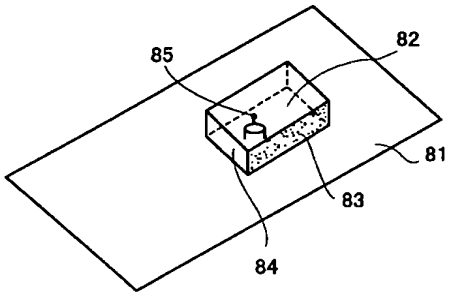
(a)


#6
#5
71
#4
#3
#a
#b
#2
#7
2
5a
#1
5b
61

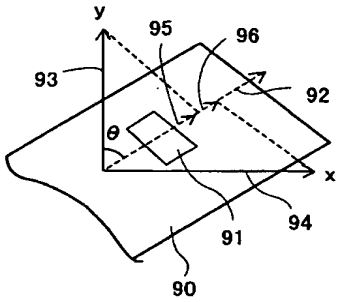
(b)


#6
#5
71
#4
#3
#a
#b
#2
#7
2
#1a
#1b
5a
5b
61a
61b

【図８】


85
82
81
83
84

【図９】


y
95
96
93
92
θ
x
91
94
90